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ABSTRACT

A Master's degree program in engineering in Portland, Oregon, was taught by faculty members who commuted from the School of Engineering at Oregon State University 80 miles away. The one three-hour meeting per week schedule maintained by this program didn't produce the quality of course that resulted from on-campus instruction by the same individuals on a two- or three-meeting per week basis. To remedy this problem a study was made to determine the feasibility of employing standard telephone circuits and telelecture/electrowriter components so that both oral and visual information could be presented at remote classrooms several times a week. A variety of arrangements in terms of meeting times, course types, instructors, etc., were used. The response of the students and instructors to this type of teaching technique was sampled by both questionnaires and individual contacts. In general, although off-campus students performed as well as on-campus students taking the same course, the students much preferred the face-to-face contact type of course. The material that must be presented visually in a graduate course seemed to be too much for the electrowriter to handle with ease. On the basis of students' comments, several suggestions were made for improving the remote courses. (JY)

Final Report

Project No. 6-28139
Contract No. 1-7-062813-4202

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USE OF TELELECTURE AND ELECTROWRITER SYSTEMS TO TEACH ENGINEERING COURSES

July 1971

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Office of Education

National Center for Educational Research and Development

ABSTRACT

The study was an attempt to evaluate the use of telelecture and electrowriter equipment for teaching engineering graduate students at remote locations. All equipment used was of a standard variety and no special classrooms, instructor techniques, etc., were initially proposed or used.

Individual contacts with instructors and students as well as questionnaires were used in the evaluation process. Since a variety of types of courses were scheduled and taught, a reasonable cross section of course offerings completed the study in terms of a relatively broad but significant sample of possible course type offerings.

In general, both students and faculty prefer the face to face contact type of presentation. The acceptability of the remote classroom telelecture/electrowriter approach depends on many factors. The study indicates that it is doubtful that the technique can be as productive as the traditional approach for most engineering courses at the graduate level.

FINAL REPORT

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The research reported herein was performed pursuant to a contract with the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

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SUMMARY

Most of the engineers in the state of Oregon reside and work in and near the city of Portland. The School of Engineering at Oregon State University is located a distance of 80 miles to the south. A Master's degree program in engineering exists in Portland and is manned by individuals who commute weekly from the School of Engineering. The one, 3-hour meeting per week schedule maintained in this program has not produced the quality of course that results from courses taught on-campus by the same individuals on a two or three meeting per week basis for shorter periods of time. This study was an attempt to evaluate the usefulness of existing equipment in order that instructors could meet with students in remote locations without having to travel more than one day per week.

The technique used was that of employing standard telephone circuits and telelecture/electrowriter components so that both oral and visual information can be presented. A variety of arrangements in terms of meeting times, course types, instructors, etc., was used. The response of the students and instructors to this type of teaching technique was sampled by both questionnaires and individual contacts.

In general, both students and faculty prefer the face to face contact type of course. The acceptability of the remote classroom telelecture/electrowriter approach depends on many factors; instructor, materials, physical facilities, etc. This study indicates that it is doubtful, in terms of the amount of material that can be learned by the student, this technique can be as productive as the traditional approach for most engineering courses at the graduate level.

INTRODUCTION

The existence and maintenance of graduate and/or continuing education programs for individuals engaged in the technological area of our economy are required. Continuing advancements of the technological area demand continual updating, expansion and deepening of the knowledge and skills possessed by those individuals participating in these areas. It has not been possible to accomplish this by sole dependence on the self-study or employer sponsored programs which were used some years ago. Organizations who can provide the personnel and facility must participate in this post-graduate education process to the limit of their ability to do so. In many cases the major organizations having the resources for this endeavor are the universities.

The Oregon State University School of Engineering in cooperation with the Division of Continuing Education of the State of Oregon, Portland State University, and others in the State System of Higher Education, industry and government, established a graduate engineering program in the Portland area. The first courses were offered during the 1960-61 academic year. Courses were open to any individual who chose to register. If the individual could qualify for entrance into the Graduate School at Oregon State University, he could work towards a Master's degree. All courses were taught by facuity members of the School of Engineering or by others certified as instructors for each particular course by the School of Engineering faculty. For reasons of economics in terms of costs and travel time to move the 80 miles between Oregon State University and Portland, courses were always taught by meeting one evening per week for three hours.

It was realized some time ago that one meeting per week for an extended period of time would not allow for the same learning opportunities which would be available utilizing several meetings per week for shorter periods of time. It was not practical however to have instructors from Oregon State University travel to Portland more than one day per week. There was a possibility of communicating only oral information on a two-way basis between classrooms in Portland and instructors through facilities at the University. This approach has serious drawbacks in engineering courses since a major portion of most lectures and discussions involve the use of mathematical equations or other graphical information. Not till the availability of equipment to transmit graphical information was consideration given to the institution of courses taught on a remote basis wherein the instructor could hold classes more than one meeting per week without traveling to the Portland classrooms more than once per week.

A proposal to study the feasibility of the use of telelecture and electrowriter systems to teach graduate engineering courses at remote locations was submitted with the intention of instituting the study during the 1966-67 academic year. Approval of this study was not received for this period. However, a continuing education type course for graduate engineers was taught using the telelecture/electrowriter system during the 1966-67 year. The instructor utilized the system

in order to bring the students together for one, 1-hour meeting on a remote basis in order to supplement a 2-hour meeting conducted in person in a Portland classroom. This was done on a weekly basis for a period of 30 weeks. Financial support came solely from the organization whose engineers enrolled in the course. Each student contributed one and one-half hours per week of his personal time; the organization contributed the remaining one and one-half hours of their time. It was felt by both the students and the instructor that the two meetings per week were advantageous and that the telelecture/electrowriter system was a satisfactory means of communication.

The study upon which this report is based was started in September of 1967 and continued through August 30, 1969. It involved the use of several (4 regular plus guest) instructors and 72 students in eight courses. Data collected in either oral or written form indicates that it is feasible to teach graduate engineering courses at remote locations utilizing the telelecture/electrowriter system. The report will indicate what is required in order that courses taught using this system are not only feasible but practical and acceptable as a substitute for "in person" instruction of a class.

THE PHYSICAL SYSTEM AND TEACHING TECHNIQUE

The physical system to meet the needs of a graduate program in engineering in Oregon is dictated almost entirely by the distribution of engineers and qualified faculty within the State. By far the largest majority of practicing engineers are located in or near Portland. The faculty of the School of Engineering is located approximately 80 miles south of Portland in Corvallis. There is a sizeable block of engineers in the state capitol area of Salem, midway between these two points. The remaining group of engineers in the state are spread sparsely over the eastern portion or in relatively remote cities in the western portion.

The graduate program in the Portland metropolitan area is then to be served by the School of Engineering faculty in such a way as to allow those people who wish to receive graduate education and/or earn degrees at the Master's level. The following will delineate the system designed to satisfy this objective.

Oral-Telelecture and Conference Telephone

Oral presentation of course material was to be accomplished by utilizing standard telephone equipment. This was possible because of the existence of telephone lecture equipment which existed at the time under the name of Telelecture. It was intended that large groups of people could be addressed over telephone facilities utilizing this equipment. Although it is not designed for small classrooms the telelecture can be used effectively.

This equipment consists of the necessary telephone connecting equipment including dial facility, a loud speaker and microphones. Two-way conversation then requires that a person talk into the microphone and listen to a return conversation coming from the loud speaker.

In classrooms of medium to large size, operation of telelecture or telelecture type equipment requires some care to prevent feedback between the microphone and loud speaker. This usually manifests itself in noise generation which makes communication impossible. The phenomenon is particularly acute in rooms which have no accoustic treatment such as ceiling tiles, etc.

In small classrooms it is mandatory that accoustic treatment be applied to both walls and ceiling. Even with this, the telelecture equipment is much too big both physically and from the point of view of power capability, and it is uneconomical in terms of cost for the number of people served.

To overcome these problems conference telephones are used in small rooms. These are quite adequate and serve the purpose well. Accoustic treatment of the room is still required. The conference telephone has another advantage in that no microphone need be handled by the students or instructor, so that freedom of motion is not restricted as it is with the telelecture equipment.

Visual-Electrowriter

The visual portion of the classroom presentation was made possible by use of an Electrowriter in each classroom. This equipment is supplied in several different forms. For this application transmitter-receivers (transceivers) were used. They provide for both transmission and reception of visual information on the same piece of equipment. Along with the electrowriter is provided a projector for magnification of the image on the machine and projection on a screen.

The system was designed for use in relatively large spaces wherein the projector presented an image on a screen behind the receiving equipment. This presents problems in classrooms of normal size since it is difficult to place the projector in the proper location. The lens system was such that the size of the projected image could not be adjusted for rooms of the size ordinarily available.

The writing system on an electrowriter transceiver is ink applied to plastic film. The plastic film is advanced as each area is used in transmitting or receiving information. Unless proper care is taken of the ink supply, the usual problems of clogging and drying occur. Another problem associated with the equipment is that the material which has been presented previously cannot be viewed again in any automatic manner because the machine does not have capability for reversing.

The equipment proved to be reliable in terms of its electronics and mechanical setup. The difficulties mentioned above are not insurmountable but they provide a source of concern. Those having to do with the projector can be corrected at some cost. Those involving the ink-plastic presentation are more difficult, and the capability for reversing the film is such as to require a considerable amount of expenditure and redesign.

Faculty

The faculty who instructed in courses available in this program were all full-time assistant, associate or full professors holding tenured positions. In most cases they taught these courses in addition to their full time schedule on campus. They were paid on an overload basis for this effort at a rate established for Continuing Education instructors. Personnel in all academic ranks receive the same compensation for this type of teaching effort.

In addition to the compensation for teaching time, travel allowance was made for those who traveled to Portland or elsewhere. These individuals also received extended distance allowance which included meals. Both of these categories of payment are fixed by the State System of Higher Education on a formula basis.

Technique-Personnel and Teaching

It has been generally understood that in engineering courses students progress faster and learn more if they are exposed to the material several times per week for short periods of time. The customary pattern is meetings of 1-hour length two or more times per week. Because of the travel distance and time involved, courses taught off-campus in Portland would meet one time per week for approximately three hours. Those individuals teaching the same course on and off campus have always noted the difference between the material presented and understood under the two teaching techniques.

It was assumed that by meeting students via telelecture/electrowriter for more than one meeting per week that the amount of material presented and the understanding of the students would be increased. As a result, the technique used here for Extension courses was changed to at least two meetings per week, one of which was conducted with the instructor in the classroom. All of the other meetings were conducted by telelecture/electrowriter.

The in-person meeting was provided so that students did have an opportunity to meet the instructor in face-to-face contact. This provided for a type of transition between the usual all "in-person" to a partial use of remote classroom presentation.

Several types of classes utilized the system. The usual lecture course with and without guest speakers or lecturers comprised the

major portion of the offerings. One course was a seminar in which both on-campus and off-campus students participated. The instructor alternated meeting the students on campus and off campus once per week. A third type of graduate course involved recitation in which the major portion of the course was devoted to problem solutions. In this case the instructor had students both on and off campus and moved alternately between the two groups of students on a wekkly basis.

In addition to the telelecture/electrowriter, notes, problem solutions and slides were made available at the remote classroom at the time of presentation. This reduced the amount of written material to be presented on the electrowriter. It also enhanced the presentation by the instructor. With a person at each location to turn on and operate the telelecture/electrowriter and other pieces of equipment such as slide projectors, a relatively smooth operation resulted.

Technique- Facilities

The basic telephone system which connected the classroom at Oregon State University to other classrooms in Portland consisted of private four-wire telephone lines utilizing the Telpak system. This system had spare facilities already assigned by the telephone company to the State System of Higher Education and provided a relatively low cost transmission medium. There were three classrooms in the Portland area; one located in facilities of the Division of Continuing Education. The other two were at the facilities of a medium sized manufacturing concern and in the auditorium of a federal agency. Each of the Portland classrooms contained a telelecture, an electrowriter and projector assembly, plus other equipment as required such as slide projectors. The Corvallis classroom contained a conference telephone and the electrowriter/projectors.

During one quarter (term) a group of engineers in Salem wished to participate in a course being taught on campus. This was done by transporting a telelecture/electrowriter system owned by Oregon State University to the Salem classroom for one evening per week. In this case the meeting place was a large office in the Division of Continuing Education facility.

The use of the four-wire, private line telephone service was originally proposed on the basis of its availability in Telpak. This approach yielded a far superior system than the two-wire service which had been used during an early trial period.

Student and Instructor Reactions

Questionnaire

In order to gain the maximum in terms of expression about the telelecture/electrowriter formal presentations, each student who had participated was mailed a questionnaire. (See Appendix A.) This

questionnaire was mailed to the students individually and they were asked to return it. Indicated on the questionnaire are the number of responses to each question and the number of comments received. Of the 72 students, 52 returned the questionanire completed.

In reading over the responses of the questionnaire it should be borned in mind that these are individuals who, in the main, have at least a baccalaureate degree in engineering. Many of them are knowledgeable about the electronics field and the majority of them have participated in off-campus courses of a nature as described previously. There is no reason to suspect that these individuals would be other than candid with their remarks and evaluation. It should also be indicated that this is the first time that most of them have been exposed to anything other than the usual face-to-face type of classroom presentation.

Appendix B contains a compilation of many of the comments received on each of the nine different questions. An attempt was made to give a representative sampling of the comments without unnecessary duplication of areas covered by the comments. Very littel editing was done in an attempt to preserve the meaning of the comments as the authors wrote them.

CONCLUSIONS AND RECOMMENDATIONS

Student comments and responses to the questionnaire indicate that the technique is useful but that they prefer the traditional face-to-face technique of presentation. Many of their responses and personal contacts with them made later in the period of time since the courses were taught indicate that the irritation caused by some of the problems alluded to in the report were major points of dissatisfaction. These items caused a negative reaction to the technique.

There is no doubt that it is feasible to teach graduate engineering courses at remote locations using a telelecture/electrowriter. The instructors and students were still able to communicate and a learning process did occur. In all instances where off-campus students were compared directly with on-campus students taking the same course there was no significant difference in the performance of students. This would indicate that the technique is successful.

A much better and more acceptable system could be developed if the following were accomplished. First of all, the equipment modifications need to be made to better match the room configerations available for classroom instruction. Along with this some improvement in the oral communication equipment would certainly be desirable. Second, rooms should be accoustically improved to give a higher quality oral presentation. Third, instructors and their materials must be better prepared. Fourth, the instructors must adapt to the system by utilizing clear, large handwriting and know the equipment and its shortcomings. Fifth, if the students were involved in the process of making the telelecture/electrowriter technique work, some real benefit

would be accrued here.

Recent developments in the area of equipment have made it possible to place the electrowriter material on magnetic tape. The material can then be played back at a later date so that it is possible for an instructor to spend some time developing the material for replay at a later time. Utilizing this approach he could then listen and comment either during or after the replay to further improve the presentation.

In conclusion it should be pointed out that acceptability of any different type of classroom presentation is greatly enhanced if the material is unavailable unless presented in the manner proposed. If it is possible for students to have high quality face-to-face type courses presented, this will certainly be the first choice. It is doubtful that, in terms of the amount of material that can be learned by the student, this technique can be improved upon by the substitution of other techniques in its place.

APPENDIX A

TELELECTURE/ELECTROWRITER QUESTIONNAIRE

Received 52 responses out of 72.

Name _____ (May be left blank)

Course taken by telelecture/electrowriter, all or in part:

Title _____

Course No. (if known) _____

Number of Terms _____

Have you taken other courses taught by Oregon State University Engineering School faculty, on an off-campus basis? Yes 32 No 20

Comments: 14

1. As a complete system for teaching graduate engineering courses at remote locations, the telelecture/electrowriter scheme held what relationship to the customary one-meeting, three-hours per week courses?

much poorer	poorer		same		better		much better
10	4	22	3	9	2	2	-- --

Comments: 25

2. Where there were problems with the system they were assignable to: (Check as many as needed)

the equipment
telelecture 26
electrowriter 43

the instructor 24

the type of course _____

the scheduling 2

the students 2

the local facilities 8

Comments: 40

3. Can the problems in question 2 be remedied? Yes 33 No 8

How? 41

4. Is it necessary for the instructor to meet the class in person when telelecture/electrowriter is used? Yes 33 No 11

Comments: 38

5. At a very much higher cost, would one-way, closed-circuit television be significantly better than telelecture/electrowriter? (This assumes an increase in the number of students and that two-way television is not possible.) Yes 17 No 30

Comments: 35

6. Would TV tape be as satisfactory as telelecture/electrowriter? Yes 14 No 35

Comments: 43

7. If you had a choice, would you choose telelecture/electrowriter with more than one class meeting per week 16

or, in person classes with one, three-hour meeting per week 32

Comments: 33

8. Would you advise others to take courses offered on telelecture/electrowriter? Yes 30 No 19

Comments: 36

Any other comments you wish to make would be appreciated. If there are points or questions which should have been covered, please feel free to state them here or on separate sheets.

Other comments: 25

SAS:em

7/31/68

APPENDIX B

COMMENTS: QUESTION 1.

1. As a complete system for teaching graduate engineering courses at remote locations, the telelecture-electrowriter scheme held what relationship to the customary one-meeting, three-hours per week courses?

I felt this method was just about equal to having the instructor in the room. You had access to him for questions or clarifying a point. The handouts and the use of the text added to the method.

Most of the lecturers worked from our classroom at Tektronics but one lecture was from Corvallis. The class from Corvallis was poorer than those at Tektronics.

It is much more difficult for the teacher to ask questions in a large class.

Much more is missed by not having a lecturer present than would be imagined. The lecturer is encumbered by the size of the writing area and the student is encumbered by the comparative difficulty of asking a question.

Technical engineering course lectures require development of complex equations. On the telelecture-electrowriter only small portions can be developed, and any previous work must be reproduced over again.

I felt that the system is not as good as being taught by a professor in front of a class.

It is my opinion, after being an instructor for about two years, that the most efficient method is to have an instructor in class and have classes as many times per week as practicable. However, the approach will help those who are not able to get to classes otherwise.

Communications and relationship with the instructor suffers.

I do not believe that the students at the remote locations responded as well to the instructor as they would have if they were in the same room. The equipment was difficult to use and read.

Some loss of effectiveness occurs because of lack of personal contact.

Better than an over crowded classroom. It also beats driving to some other town to take a course. The only drawback in my estimation is when students are too shy to speak and when the equipment is not operating properly.

Reference to previously written material would be desirable.

The system represents an improvement over previous class schedules. This particularly concerns travel and timesaving.

I think it is an excellent way to assemble students at remote locations and disseminate information.

If used properly I feel that the system coupled with slides, etc. can be a powerful teaching aid.

It is slightly impersonal and the feedback between class and instructors is not as effective.

The burden to learn strongly rests on the student. The course outline for study is necessary so the student can be prepared for class. Then more question and answer discussions can be accomplished. Otherwise only poor notes can be taken, requiring diligent study to learn what went on.

If the instructor is prepared and experienced in the use of the system and the bugs are corrected the effect is about the same.

Communication is a bit depersonalized. No side commenting or elusion to material can be experienced.

The screen and writer are not sufficiently large for courses where sketches and explanations are required.

Technical problems continually interfered with the operation of the system. It seemed as though less was accomplished in the same time period.

I will not take another course by telelecture-electrowriter system.

COMMENTS: QUESTION 2.

2. Where there were problems with the system they were assignable to: the equipment, the instructor, the type of course, the scheduling, the students, the local facilities?

The principal problem was that the instructors were not familiar with the equipment and therefore not use to it. In general it interfered with their usual style of delivery.

You can not read the diagrams of the electrowriter unless they are quite simple or with large lettering which is usually not the case. You can not refer to previous portions of the problem.

Electrowriter makes small print most difficult to read. Instructors had difficulty writing on small screen. Students must copy very fast as available space permits only a few lines to be written at a time.

The only problem I observed was the inability on the part of the equipment to faithfully reproduce small movements. In other words it had a resolution problem.

The audio equipment at the Corvallis end gates were on and off depending on how loud the speaker speaks. This results in long periods of silence in Portland even though a lively class discussion may be taking place in Corvallis. The type of course content to be given out must be well organized. Material could be given as handouts prior to class because of time it takes to put all equipment on to the system.

The system microphone pickup for the instructor seemed very poor. Whenever they would lean away from the mike we would get no voice. A better mike or a neck mike might improve this, also hum, buzz, etc. from the equipment was a disturbing factor. Another problem was the operation of the writer. We seemed to be troubled with stylus drag in our machine. This would often obliterate data when using the stylus as a pointer. Additionally it must have been extremely difficult to write with the mechanical linkage of the machinery because we got scratching which was extremely difficult to read, and this is not normal from the instructor involved.

Due to poor preparation, classes often started as much as 30 minutes after we assembled, particularly slides were late in arrival. Sloppiness of writing by some instructors was generally made still less legible by the machine, particularly in occasion of a malfunction. The machine would write various lines as the stylus was being placed to write a word.

An instructor usually has troubles the first few lessons, and where the instructor is changing two or three times during the term this causes problems.

There were some electrical problems which were a bit distracting but these were understandable, so were accepted.

Instructors were not use to the equipment and handled it awkwardly and poorly. The equipment didn't write properly at all times.

Main problems seem related to a general lack of coordination, supplementary materials, equipment, assignments. I had a vague sense of being neglected. Guidance, organization, instructor, etc. should be extra clear to make up for remoteness.

The electrowriter isn't as good as a blackboard because of space limitations, inability to backspace and resolution. However, the spontaneity and talkback features are far preferable to slides. All in all it is quite successful. I think good two-way amplifiers on each end would contribute greatly to the success of this program. In the case of a seminar, the inability to carry on a normal conversational level interchange tended to fragment the discussion into two groups, in particular those listening to the terminal which gated off unless someone spoke rather deliberately into the microphone.

Sometimes phone lines were disconnected. Noise on the lines was annoying. Higher grade voice channels should be used. Preferably leave this system hooked up during non-use but turned off. Too much time is wasted hooking up at each class meeting. The equipment works but meetings in person cannot be totally replaced.

The instructor is forced to write everything. Too much time and attention is directed to his performance and away from students. The space available for writing is limited. Would have to rewrite several times per class period. Reproduction at receiving stations was smaller than at the writing end, thus instructor is forced to write big and thus multiplied problems.

The system is new to all of those involved and I can't say there are any problems. Occasionally the film was moved prematurely and we lost material that was contained thereon. It is a minor problem. One that will be corrected once those involved will become accustomed to the equipment.

There was frequent failure of the electrowriter. There was hesitant interrupted speech of the instructor, causing breaking in the train of thought.

Waiting for equipment to warm up and taking away about 10% of the time is not tolerable. Instructor should be well prepared for each lecture and have very good handwriting.

In the case of a seminar a different speaker for each class means that the instructor is always getting use to the equipment. The writing area should be larger.

Equipment reliability was fair but the display area is too small. The course needs a lot of blackboard work which allows referring to previous steps to presentation and equipment.

Space to write was very limited, so the instructor had to keep the film moving. The students had no way of looking back for reference unless they took all the notes down. The instructor found it hard to reference back. The pen did not provide sharp point sketch or write clearly.

The microphone used by the instructor didn't allow him any freedom of movement, he could not write and talk at the same time. Also the microphones in the classroom were inconvenient. The student had to get up from his seat to ask a question, he couldn't take notes during this time. We got acoustic feedback between speaker and microphones at all locations. The electrowriter had various problems during class. The instructor had some problems in adjusting to presenting his material into a microphone without a live class. The screen size was too small and the drawings had to be made over again and again as the film was advanced. I don't believe the problem can be solved using present equipment.

Unless the instructor is very careful the transmitter writing was illegible. Since we had different instructors for each meeting (seminar) the time spent with familiarization with equipment was excessive.

Instructors are as hampered by the equipment as the students. Questions from the class are almost impossible to ask or answer. Students feel they don't want to hold up the class as much of the class is unseen.

I didn't care for losing a prime hour out of the middle of the day. Generally other matters were on my mind so that I couldn't pay close attention to the material as I would like to have done.

There were technical difficulties with the equipment but nothing excessive. One would expect to have a little trouble once in a while.

The screen frequently was not readable and the receiving and sound system did not work correctly at times.

The instructor needs more practice with the system especially for a seminar which has a new instructor each week.

The speaker-microphone system produced feedback except at uncomfortably low volumes. The electrowriter would reproduce only lettering and diagrams at a scale so large that an unacceptable small amount of material could be presented per frame.

Even if the equipment had worked perfectly the system was very unsatisfactory.

It is too hard to ask questions. The screen is too limited in size and not always clear, actually hardly ever clear.

The material once presented could not satisfactorily be reprojected.

COMMENTS: QUESTION 3.

3. Can the problems in question 2 be remedied?

Improve the writing pen in the electrowriter for finer line and easier writing.

By having the instructor prepare with and for the equipment.

Electrowriter probably can not be made satisfactory without complete re-engineering. Instructors can become familiar with the electrowriter before class begins. Not all can write well in the limited space anyway.

Need improved equipment and trained instructors.

Because the system is a less direct form of communication it can never be entirely equivalent to the normal classroom situation. It can probably be comparable to some of the very large classes on other campuses. Part of the battle is just learning to use this system effectively. Both students and instructors must view the situation differently and expect different things than for a regular class. The students must learn to operate more independently and the instructor must plan and prepare more thoroughly. Omissions and oversights are easier to make and less noticeable at the time. Since the instructor cannot see raised hands in case of questions, the students must abruptly interrupt, and many are reluctant to do this. Thus questions often go unasked. There is a tendency for the lecturer to go too fast and not allow enough time for taking notes before advancing the electrowriter frame. Perhaps individual buttons to operate a signal light in case of questions and a reversible drive on the film would help.

Spend a bit more time to set up and check out the equipment before classes.

If the telelecture screen can be enlarged to capacity equal to two 4 x 8 blackboards as used in the normal lecture room.

The problems are remedied because there were no failures during last term.

Perhaps the following items would help. (1) A larger field of view would enable larger writing and retention of data for referral. (2) Familiarization and practice with the machine and adopting a style of presentation to suit machinery limitations. (3) Getting the machine to operate properly.

Planning and preparation and logistics can be vastly improved. The legibility problem requires the instructor to take great pains in writing more legibly.

Perhaps a more thorough introduction to the electrowriter for new instructors would help.

A large format on a screen would help. The problems cannot be remedied because they are fundamental. There is a loss of personal contact with the instructor and taking of useful class notes is difficult to impossible.

Have a knowledgeable technician on hand to make adjustments prior to beginning of class and train one or two students how to use the equipment.

The area for writing on the electrowriter should be larger. Some of the instructors can be more effective in the use of the system than others.

Equipment should be connected continuously and this involves the establishment of a permanent classroom with the equipment in it.

Closed circuit TV would be much more desirable.

A little exposure to equipment prior to the class would help.

Have a service representative set up the equipment and remain with it through the first few lectures. Replace ineffective instructors.

Increase the size of the screen.

Modify writing space size and maybe have an area aside from removing the sheet in which constantly referred to information and equations may be shown.

The instructor must be better prepared than he would be for direct contact presentation.

Problems can be remedied by two sets of equipment, one for questions and scratching around and the other for formal well organized development of material.

Have the equipment serviced more often.

A technician should be present at the start of each class to assure proper tuning of the equipment. Chairs and tables would be better for the students than would armchairs. Two or three students to a table and one microphone to a table will aid in student and instructor discussions.

I don't think the problems can be remedied. The electrowriter cannot be used effectively the way it is constructed and used.

Give the instructor a mike to hang around his neck like is used on TV. Arrange a speaker and microphones to eliminate feedback. Next supply at least one mike for each three students placed within their reach.

The technical problems with the electrowriter could probably be solved, however there is a reluctance to interrupt the instructor.

Perhaps microphones placed among the class will permit more dialogue between the instructor and students.

Instructor training and preparation is very important. A logical development and clear presentation is important. Pauses during a lecture before advancing the telewriter are necessary for maximum clarity.

I would think that the equipment of this nature could be maintained in a condition to work better.

It is inconceivable that a system as crude as this could be sold in the sixties.

Better scheduling and organization and pretesting of the equipment is necessary.

Need improved equipment.

COMMENTS: QUESTION 4.

4. Is it necessary for the instructor to meet the class in person when telelecture-electrowriter is used?

The instructor should meet with the students in order to answer questions. The course would have been better with the instructor in the classroom.

The instructor met the class on some occasions. Two other persons and myself out of about nine taking the course in Salem felt it would be worth the effort to drive to Corvallis to see the instructor face to face.

The instructor need not meet with the class very often, but I think it would be advisable to meet with the class every few weeks.

Unless teachers are available to ask questions, i.e. react to immediate student feedback, I'd rather read a book. It's more legible. The course can be programmed; there is no advantage to the class group sitting.

I believe that complete elimination of person to person contact would result in poor instruction.

For Engineering courses at least two or three meetings per term are necessary.

A simple one time meeting to introduce the instructor would waste everybodys time.

Need someone to set up equipment and pass out materials, etc.

This is very essential. The teacher-student communication is at its best when they meet in a classroom. Once or twice during the quarter it would be nice to assure productive question and answer discussion on a more individual basis.

Students tend to ask more questions when the instructor is present.

All questions cannot be answered by phone. Discussion on returned homework and quizzes needs to be in person.

There is greater difficulty in asking questions when the system is used. The instructor is more at ease in person than in presenting material through the system.

Really there is no need for the instructor to be present. This is a selfish comment but when we have a different man each week (for seminar), many of them experts in their field, I would like to get a glimpse of them so that I might know them at a later time.

The instructor should meet with the class once every two weeks.

I feel there should be contact several times throughout the course. A teacher's general experience cannot be found in textbooks.

Some persons do not lend themselves to discussion on the tele-lecture. Also some students may wish to speak to the instructor personally, although it may be better if everyone can share in the discussion.

Not absolutely necessary but certainly highly desirable for at least part of the meetings.

The answer depends entirely on the ability of the teacher to get the information to the students. With a well qualified teacher I would think that in person meetings would be delivered once or twice during the course.

Periodic visits are desirable to break the ice and establish familiarity with the student and instructor. Also allow for specific questions which may not be of interest to the whole class.

The loss of eye contact and blackboard communication is a short coming of the system. Instructor contact is useful in adding a personal touch.

Once every few weeks would prove to be advantageous.

A good feeling must exist between teacher and student for an efficient process. Face to face communication often increases the students confidence in an instructor.

It is better if you know the instructor.

It is necessary for students to communicate personally with the instructor at least once every two weeks. Once a week would be preferable. A student-instructor contact is not necessary as long as questions can be answered. Time will be wasted if meetings with instructors are only used to catch up with lost information.

I believe personal contact would help.

Student-instructor contact gives better opportunity to get to know each other. Far more detailed discussions of problems can be held.

Occasional personal contact is better between the instructor and class.

Contact is desirable but not absolutely necessary. It allows a certain amount of free discussion to take place.

At least one meeting during the term would be preferable at the start of the course to help get things going smoothly.

COMMENTS: QUESTION 5.

5. At a very much higher cost, would one-way, closed-circuit television be significantly better than telelecture-electrowriter? (This assumes an increase in the number of students and that two-way television is not possible.)

It would allow the instructor to use blackboard so illustrative examples, sketches, etc. would have more room and higher quality. There would still have to be two-way audio communication.

Certainly the reproduction material would be better.

There is no chance for students to communicate with the instructor and clarify uncertainties or ask questions.

I believe closed circuit TV with two-way voice communication would be superior to the electrowriter.

Only if two-way sound is available and the present system cannot be improved.

Better but not significantly better.

Perhaps it would be better. It would allow the instructor to project the materials that have been prepared before hand.

Yes, if students could communicate questions to the instructor.

This is hard to answer. Unless students have a way to communicate with the teacher it is hard for the teacher to understand the problems of the students. Many students seem too shy to ask questions when they have to walk to a microphone to communicate to the other end.

We might as well make a movie of the class lecture for showing at remote places. For technical classes I prefer live contact even by phone.

Should be live and not a canned session.

Slow scan TV with memory would be better because a lecturer is visible and if properly done more blackboard space would be available. Students would have more monitors if needed.

The instructor should appear before the class in alternating sessions.

Seeing the teacher would not offer any substantial benefit since personal contact still wouldn't be there.

Immediate graphic feedback from class to instructor is required.

Need two-way communication, written and oral.

Students should be able to question the instructor by a telelecture type system.

Instructor wouldn't have to concentrate on the electrowriter in a TV situation.

I have no experience with television. This system in question is satisfactory. It meets the minimum requirements for the course.

Television will depend upon the teacher. If he or she goes beyond the write it out technique, Yes. Otherwise the cost increase wouldn't be worth it.

It would not in my opinion be any better than the electrowriter because the electrowriter offers everything that closed circuit TV offers for low cost and in real time class.

I would say that two-way telelecture is better than one-way TV. This allows the student to ask questions and to clear up a point before the instructor moves on to something else.

Although this would not be as good as one three-hour live class a week, it would be a vast improvement for the following reasons: There would be visual contact with the instructor. Note taking would be improved because a full blackboard would be used. Visual aids could be used by the instructor.

It would allow scanning of total blackboard area.

It would be subject to many of the same disadvantages and in addition it would preclude on-the-spot dialogue and discussion.

Probably not better, some of the same problems would remain. The electrowriter does have the advantage that students can communicate to the instructor although it is slightly inconvenient and difficult.

If the telelecture-electrowriter is working properly I do not think the improvement would be significant enough, however, like the nursery rhyme, when the telelecture is good it is very good, but when it is bad it is horrid.

Having taken several undergraduate TV courses I found that they tended to degenerate into a formalized TV epic in which no one benefits, with the possible exception of the instructors ego. Two-way communication is an absolute necessity.

I think the success or failure of this method depends solely on the instructor not the medium.

The student must be able to communicate to the instructor with written messages.

Yes, if the lecturer writes well at a blackboard, and no, if the lecturer has no written materials.

COMMENTS: QUESTION 6.

6. Would TV tape be as satisfactory as telelecture-electro-writer?

It would be impossible to ask any questions which always arise in a graduate level course.

If a set of lectures were video-taped showing the class participation dialogue I think it would be an effective and successful class.

This class and possibly any other engineering courses aren't set up to work well with either method.

Probably the principal reason for having an instructor lecturing rather than a correspondence course is the give and take between the instructor and student and the clarification of difficulties as they arise.

No communication between students and instructor.

Would there be a method in which questions could be asked and answered as the lecture progressed?

Lack of ability to ask questions would be very detrimental to understanding the material in a technical course.

No. Questions would then be impossible.

Need to be able to ask instructors questions at the time the question occurs.

I don't think so.

Must have an instructor to answer questions either by phone or in person.

Two-way communication is required.

No feedback to instructor during class. Movie film makes playback cheaper. Video-tape requires either much editing and/or very talented instructors.

Telelecture system has potential for give and take or questions and answers which I feel is imperative in graduate courses.

Only in a history or philosophy type course where communication between professor and student is not technical.

TV tape does not allow discourse between student and teacher. I found with the electrowriter each student can have equal opportunity for participation.

Interaction between class and professor is essential.

I haven't had any experience with tapes. The problem here is that the student couldn't interrupt the tape as one can do with the telelecture. Therefore, if there were questions, one would have to hold them until the end of the lecture or some other time.

Probably better. Teacher could use other methods. Could be rerun perhaps for restudy. Suggest tapes and equipment be available to individual students to use on his own time.

I think this would have all the disadvantages of the telelecture-electrowriter system without any interplay between instructor and student. This might be appropriate for history and geography, but I don't think it would be particularly good for advanced scientific curricula.

Yes, provided it is used in conjunction with a telelecture-electrowriter so student and teachers can communicate with each other as the need arises.

Much would be lost for any class when there is not some sort of communication between student and teacher throughout any class period.

Again I believe that two-way communication between student and teacher is best. TV tape in my opinion will work only if the TV lecture is extremely well prepared and the lecturer is able to anticipate and answer questions in advance.

Would not be able to ask questions.

I am sure the nature of the course is a significant factor. Probably more or less equally satisfactory. Note again the advantage in telelecture of reverse communication.

Probably better if rehearsed.

Probably not for the type of course at a graduate level. There is no chance for questions or review.

Efficiency is proportional to having questions answered as quickly as possible.

It is difficult to get clarification on questions and problems from a tape recorder.

Because of lack of direct communication between student and instructor the system is not as good.

Not unless there is an opportunity to interrupt the tape and question the instructor.

Not for engineering type lectures. You could not ask questions when you did not understand some part of the problem. It is important to follow through the solution from start to finish in solving problems in engineering.

COMMENTS: QUESTION 7.

7. If you had a choice, would you choose telelecture-electrowriter with more than one class meeting per week or in person classes with one 3-hour meeting per week?

I believe one 3-hour meeting per week in person would be better than several telelectures per week because the former give the student a chace to learn the material.

My attention span is approximately one hour. I would expect to see on telelecture a better instructor than is usually found at university extension centers in remote areas.

I would chose telelecture-electrowriter if the class was held immediately after work, travel distance to class was short, equipment was improved, and instructor was available several times a term in person.

Personally I would rather set aside a few hours once a week to devote entirely to class rather than three shorter more broken up periods three times each week.

I would accept telelecture-electrowriter classes if this is the only way I could attend classes or if by using this system more classes were made available.

I don't think I will take any electrowriter classes again regardless of transportation conveniences.

My personal schedule better fits the one night per week and study the one or two remaining nights.

This is assuming that the instructor will not appear in person at all with the telelecture system, I would prefer the alternate sessions with the instructor.

Really depends on type of course and instructor. Some instructors are hard to follow in person and they are even more difficult on equipment. Visual feedback to instructor is difficult.

I think that the unknown second choice would be worth the risk as far as I am concerned.

I feel that one 3-hour class is adequate. Also this leaves a greater possibility for taking more classes.

I have a limited attention span and you can prepare better for shorter sessions.

I would prefer the one meeting a week when one must leave a place of work and drive to Corvallis. I don't think there is much advantage in having an instructor present.

I recommend using telelecture-electrowriter in conjuction with in-person class meetings. The ratio should be determined by the students attending the class. Example, one out of every two, three out of every four, etc. should be in-person.

After 1-1/2 hours of class one's ability to absorb new information decreases.

Three hours is a long time to try and maintain a span of attention on a technical subject. More than that however, it is hard to find a week night which doesn't conflict with someone's technical meetings, Reserves, or Boy Scout banquets. These can usually be accommodated with the multiple shorter class sessions. A three hour meeting can be very long and tiring no matter how interested one is.

I really prefer telelecture once a week since most of my evenings are already tied up with other business.

One live 3-hour class per week is far superior to any long distance technique.

I would greatly prefer a personal contact for one 3-hour session.

I believe it is difficult to maintain a high interest level for the longer period.

I am afraid that the amount of knowledge picked up during the second half of a three-hour meeting will be very low unless the professor is an excellent teacher and knows how to keep the attention of the class.

One 3-hour meeting is an awful big load to drop in one pile.

I think there is too long a "soak" time between exposure in a once a week class. I could get more out of three one-hour lessons than out of one 3-hour lesson.

There is no substitute for student teacher interaction especially in upper division and graduate level.

Much more time is needed with the telelecture than the in-person class.

I need personal contact with the instructor.

Depends upon the instructor.

COMMENTS: QUESTION 8.

8. Would you advise others to take courses offered on telelecture-electrowriter?

Not unless there is no other way to get the course.

I consider my experience with the telelecture unsatisfactory and think I could have learned the course material better in personal contact with the instructor.

It would depend upon the nature of the class but probably not.

Although inferior to the in-person classes I still believe the telelecture-electrowriter to be a definite advancement to the field of education. If the classes are small and there are not too many terminals, this method of teaching would be very effective. Even more so in non-technical courses.

Only if necessary.

No. I would change this to yes if the equipment was improved.

Certainly if the course were offered no other way and were a real value such as this course.

Any means is better than no course.

I believe that more graduate courses can be made available in the Portland area through use of the telelecture-electrowriter system because the instructors won't have to make the long trip. Perhaps further use will cause later acceptance.

No, because a student doesn't get too much out of the electrowriter presentation.

Anyone interested in learning can greatly benefit from this type of program.

Providing that the instructor meets with the class periodically.

Depends on course, but system is marginal in highly technical course.

As opposed to nothing as an alternative.

Yes, if the nature of the course and the instructor are considered. Depending on individual courses, etc.

There is no difference in this system than a professor in a large lecture hall. The whole thing is so impersonal that I see no advantage in having a man present.

The capacity of this system to offer courses is convenient to the participant in the use of his spare time.

Would not advise against it.

The future of technical education lies with information handling media, classroom facilities of a contralized campus are too restrictive.

It is not a preferred system but a useful experiment. If the subject matter is important to someone he should not let this system discourage him.

If the course to be taken is of a highly technical nature as in engineering, I think that an instructor in person is a very distinct advantage.

If courses were offered this way and not some other way.

It would depend upon the course offered and if the lecturer was familiar with the equipment.

Any method to follow courses is good but the best way is in the classroom with the professor in front. He can see the reaction of the students, and the students immediately can interpret him. However, classrooms are not too wide spread. A reasonable substitution is the telelecture-electrowriter system. There is two-way communication but the professor cannot see the reactions of the students. When the telelecture courses are given from a live classroom most of this problem is solved. I saw myself in the telelecture room as a blind student following a course without seeing the professor, however I can read my books. I hope that the telelecture system comes back as this offers an opportunity to follow classes which are given in Corvallis and that is too far away to attend one or two classes a day.

As long as a student can periodically meet with the instructor in person I see little difference between this and on campus classes.

With the qualification that like any in-person class it will only be as good as the lecture.

For a lecture-only class the electrowriter system is quite satisfactory. For math or other classes with a lot of writing, only if the instructor can write well on the electrowriter.

In-person lectures often are much better atmosphere for learning.

If the course did not involve a considerable amount of mathematical problem solving, technical diagrams and sketches.

MISCELLANEOUS COMMENTS

I feel that the key is proper preparation for delivery by whatever medium is used. The one lecture from Corvallis was well prepared. The instructor had slides available at all three remote classrooms and they were displayed as he called for them.

If classes really are small then the electrowriter is fairly satisfactory as students may all sit close to the microphone. Interaction is especially important at the graduate level. Provisions should be made to retain the lecturers notes on the viewing screen for some time after the lecturer has taken his hand out of the viewing screen. Perhaps the electrowriter could be made to advance the sheet approximately 1/3 of the present distance instead of making the field of view larger. Then notes above the lecturers hand could be copies as his hand moves.

I think there is a good future for this system, however two-way TV would be better. It does require much from the instructor, confidence from students, and good lecture material and presentation.

The disadvantage in this system and possibly in TV is the problem of taking notes. If you get even slightly behand the instructor in note taking you are lost because the screen progresses to new material. In a classroom one can often take some notes considerably behind the instructor since the information remains on the board. Thus one can better alternate attention between concentration to understand and note taking. The mechanical performance of the electrowriter was less than perfect and perhaps could be improved.

I think it would be desirable for the instructor to lecture from either a published text or detailed notes prepared and distributed to students in advance. Then the main feature of the electrowriter would be for discussion, elaboration, explanation, questions, and the like.

I am 100% in favor of the telelecture system. For many it saves much time and effort that would be required to commute between home and campus.

It might be interesting to try some live weekend sessions, possibly interspersed with telelecture on a reduced basis. I believe this has been suggested.

This was my first course on an electrowriter. I am sure there was some inconveniences but they are not insurmountable. I rather enjoyed the course. The subject material was challenging, the instructors seemed to be thorough and students interested. I am all for this kind of instruction whenever and wherever it is available, especially for such small classes.

Something to supplement the lack of "office hours" would be of value when using this system.

Visual feedback is important for both students and instructors.

Most Civil Engineering courses require many sketches and diagrams which are difficult to make with the electrowriter. The area for writing is so small that a number of sketches that can be seen at one time is very limited. Another problem is the fact that after the film has been advanced it cannot be returned, therefore, the diagrams are lost and have to be redrawn in many cases.

It is my firm opinion that classes conducted in the presence of the instructor is the best answer. Any other media is a failure. In the above course I took I notice that 95% of the students were dissatisfied with the electrowriter system. Many of them had questions to ask but they were either shy or too lazy to walk to the microphone to talk to the teacher.

Two-way TV is best. Telelecture-electrowriter would be okay if many microphones are among the students. The system is limited to material that can be written and spoken only. It is pretty much one-way communication. The best by far is for the instructor to be present in a responsive interested class.

Preparation is important. The system makes it difficult to communicate information to or from the instructor. Each question takes longer to ask and longer to answer. Consequently the class question-asker does more damage than normal. This student is also harder to control in this situation. If after due consideration you decide to ask a question, the key to asking effectively is to speak in a clear concise complete statement. Much of our troubles related to asking incomplete questions couched in too colloquial words that were easily misunderstood. We didn't quite speak the same language.

The basic concept is good. The mechanism is primitive. In this day and age we can talk about putting men on the moon, we should be able to devise a better method of remote teaching. If remote teaching can be perfected it will allow people away from the urban centers to have access to postgraduate instruction on a non-college residence basis. To me one-way TV or two-way audio would be the best answer. The personal contact with the instructor is still most favorable.

If the microphone feedback problem could be solved, probably a course which required only a limited amount of material presented in conventional long hand to be transmitted by the electrowriter could get along satisfactorily. Engineering diagrams and sketches just don't go.

I found this system so unsatisfactory that I drove to Corvallis to watch the lecture at the originating classroom for most of the term.